March 21, 1995

David N. Kennedy, Director
Department of Water Resources

Boyd Gibbons, Director
Department of Fish and Game

- Department of Fish and Game

Delta Pumping Plant Fish Protection Agreement - Hills Ferry Fish Barrier, Fifteen-Year Plan

This is to request approval of the attached proposal to install and operate the Hills Ferry temporary physical barrier on the San Joaquin River at the Merced River confluence each fall for the next fifteen years. Approximately 10 acres of property will also be purchased to secure long-term access for barrier installation. The barrier will prevent an estimated average of 38 percent of all salmon reaching the San Joaquin/Merced River confluence from straying into the upper San Joaquin River, and west side sloughs and canals. The barrier will enhance salmon production at the Merced River Fish Facility and at natural and reconstructed spawning riffles in the Merced River.

The project is estimated to cost about $917,000 and is expected to provide an average annual smolt credit of approximately 110,129 additional smolts at Mossdale on the San Joaquin River over the 15-year life of the project. The annual cost of approximately 56 cents per smolt is comparable to several previous salmon improvement projects in the area.

The project will help to offset the annual salmon losses at the Harvey O. Banks Delta Pumping Plant starting in 1995. The estimated annual contribution will be based on the actual annual escapement estimates. The Department of Water Resources and the Department of Fish and Game may subsequently agree to modify the benefit estimation procedure as refinements are made.

The Delta Pumping Plant Advisory Committee reviewed the proposal and recommends its implementation using funds from the Delta Pumping Plant Fish Protection (4-Pumps) Agreement's annual account. We also recommend approval.

RECOMMEND APPROVAL:

Randall L. Brown, Chief
Environmental Services Office
Department of Water Resources

Date 3/21/95

Perry Herrgesell, Chief
Bay-Delta and Special
Water Projects Division
Department of Fish and Game

Date 3/24/95

APPROVED:

David N. Kennedy, Director
Department of Water Resources

Date 3-28-95

Boyd Gibbons, Director
Department of Fish and Game

Date MAR 27 1995

Attachment

DELTA PUMPING PLANT FISH PROTECTION AGREEMENT

PROJECT PROPOSAL

HILLS FERRY FISH BARRIER

FIFTEEN-YEAR PLAN

1995-2009

Prepared by:

Department of Fish and Game
Region 4
and
Inland Fisheries Division

December, 1994

HILLS FERRY BARRIER: FIFTEEN-YEAR PLAN
1995-2009

INTRODUCTION

Fall-run Chinook salmon populations in the San Joaquin River basin have declined to seriously low levels. Estimated spawning escapements in 1993 totaled 2,600 adults compared to historic levels of 70,000 fish in 1985, and 80,500 in 1953. Escapement in 1994 is expected to be slightly higher than 3,000 adults.

Prior to 1988, significant numbers of San Joaquin River salmon strayed during their upstream spawning migration. These fish did not enter their natal streams, but continued up the mainstream San Joaquin River into west side sloughs and canals. These sloughs contain poor quality water and have no suitable salmon spawning habitat.

In 1988, the Department of Fish and Game (DFG) began an adult trapping and egg salvage effort in the west side sloughs and canals. Funding was provided by the Commercial Salmon Trollers (Salmon Stamp Funds). We continued this effort through 1991. During the spawning season, trapped fish were spawned and the eggs transported to the Merced River Hatchery for incubation and rearing.

Although the Department had some success in salvaging eggs from fish straying into west side canals and sloughs, a more efficient solution to the straying problem was needed. The salvage operation was costly and did not allow these salmon the opportunity to spawn naturally. Also, the Department of Water Resources (DWR) pursuant to the Delta Pump Fish Protection Agreement (DPFPA) had funded several habitat and hatchery improvement projects on the Merced River. We placed high priority on guiding fish into the Merced River to increase natural spawning and utilization of these mitigation projects.

In the fall of 1992, a temporary electrical fish barrier was installed and tested on the mainstream San Joaquin River immediately upstream from the confluence with the Merced River, near the town of Hills Ferry. Funding for installation and operation of the electrical barrier was provided by DWR, pursuant to the DPFPA. A temporary fish trapping facility was installed immediately upstream of this barrier to monitor the effectiveness of the electrical barrier in blocking fish passage. Funding for the trap was provided by the Commercial Salmon Trollers (Salmon Stamp Funds). In association with the 1992 barriers, increased water releases were provided from the Merced Irrigation District (MID). These attractant flows in the Merced and San Joaquin Rivers were secured by the sale of water from MID to the State Drought Water Bank. These measures (the barriers and attraction flows) were generally successful in guiding fish into the Merced

River and preventing fish straying. Problems with electrode stability, fish passing the barrier, and public safety resulted in a DFG and DWR staff decision to terminate the electrical barrier program.

In the fall of 1993, a pipe-rack fish barrier was installed and operated at the same location as the electrical fish barrier. The basic structure of the physical barrier followed the design of the weir installed upstream of the electrical barrier in 1992. Tripods spanned by horizontal pipe rails were placed across the river. This structure supported vertical steel racks in the configuration of an "Alaska Weir," effectively blocking fish passage. Funding was again provided to DFG through DWR, pursuant to the DPFPA. The 1993 Hills Ferry physical fish barrier proved to be as effective, or more effective, in guiding fish than the electrical barrier. It was safer, easier, and less expensive to operate.

On October 1, 1994 DFG personnel installed the Hills Ferry physical fish barrier. This barrier is constructed, located, and operated the same as the 1993 barrier. Preliminary reports suggest good results again this year. Problems with barrier operation have not occurred and are not anticipated. Funding was provided to DFG through DWR, pursuant to the DPFPA.

DFG has evaluated the feasibility of installing a permanent base for this physical barrier. Engineers have confirmed that the silty bottom will make it difficult and expensive to construct a permanent support structure or permanent barrier at this Hills Ferry site. Alternative sites on the San Joaquin River upstream of the Merced River confluence are available, but would not be as effective in guiding fish to natural spawning areas. Based on these observations and present technology available, a temporary seasonal barrier ("Alaska Weir") constructed and operated at the Hills Ferry site is the best option to prevent spawning fish from straying past the Merced River confluence.

PROJECT DESCRIPTION

The DFG requests funding to 1) install and operate the Hills Ferry temporary physical barrier on the San Joaquin River at the Merced River confluence each fall for the next 15 years (1995 to 2009), and 2) to purchase the property necessary to secure access for this project. This extended funding commitment and land purchase would allow the DFG to obtain permits, contracts, and environmental compliance for a longer period, thus relieving the workload required to comply with the environmental and administrative requisitions each year. The project will act as a cornerstone for restoration of the salmon fishery in the Merced River. The barrier will enhance salmon production at the Merced River Hatchery and salmon use of natural and reconstructed spawning riffles in the Merced River.

The basic structure of the Hills Ferry temporary physical barrier will follow the design of the weir installed in 1993 and 1994. The tripod stands, pipe rails, and steel racks constructed in 1993 and 1994 will be reassembled in 1995 and subsequent years to form an "Alaska Weir" across the San Joaquin River. One section of the steel racks will be removable to allow boat passage. Assuming the normal range of fall flow conditions, the 10-foot racks used in 1994 should be adequate for the 15-year program. Higher than normal flow may require the extension or modification of existing racks. This possibility has been incorporated into the weir design. Minimal damage to some racks and tripods occurred in 1993, and will likely occur during the life of the project. Maintenance, repair, and replacement of parts are expected to be nominal.

The barrier will be erected on-site each year by DFG personnel in late September and operate until late December. Exact construction and removal dates will vary. The weir will be staffed to assist with boat passage around the barrier and clean debris from the racks. A trailer will be placed at the project site to be used as project headquarters and to house DFG personnel.

It is important to note that access to this barrier site has been granted by the present landowners. The concept of a permanent easement is not acceptable to the current owners. Because of divorce and financial problems, the property owners are anxious to sell this property. If this property is sold, access may not be granted by the new owner. DFG proposes to acquire approximately 10 acres of this property to ensure long-term access to this critical site. This acquisition is crucial, because the loss of access to this site may preclude effective operation of the fish barrier. If this proposal is accepted, we request that up to $20,000 be immediately contracted to the Wildlife Conservation Board in order to initiate and complete administration of the land acquisition. A land acquisition evaluation is included as an appendix to this proposal.

MAGNITUDE OF POTENTIAL BENEFITS

The Hills Ferry physical barrier will prevent passage of salmon into the upper San Joaquin River, and west side sloughs and canals. The "Alaska Weir" has proven effective at this and other sites. No formal monitoring studies are proposed for this project. However, monitoring the benefits of other projects (Merced River Hatchery production, salmon use of reconstructed riffles in the Merced River, and salmon smolt survival) could yield useful information on the benefits of the barrier. The project life of the Hills Ferry Barrier is 15 years. The components of the "Alaska Weir" could be used longer if management decides to extend the project beyond 15 years. The extended use of the "Alaska Weir" will be continually reevaluated as new technology becomes available.

Estimated Benefits

To estimate the benefits of the Hills Ferry fish barrier, the known "low" and estimated "high" percentage of salmon straying into west side sloughs during the 1988 to 1991 egg salvaging efforts was calculated (Table 1). Thirty percent of salmon reaching the San Joaquin/Merced River confluence were trapped from west side sloughs from 1988 to 1991. Regional DFG biologists estimated that those salmon trapped represented only half the actual number of straying salmon. Using this larger figure (two times the number of trapped salmon), it was estimated that up to 46 percent of the fall-run salmon reaching the San Joaquin/Merced River confluence could have strayed during 1988 through 1991. Using the average of these two appraisals, we estimate that 38 percent of all salmon reaching the San Joaquin/Merced River confluence will be saved from straying because of the Hills Ferry barrier. This assumes a comparable level of production at the Merced River hatchery and continued outplanting for yearling and smolt studies.

Table 1. Estimate Of Salmon That Strayed Into West Side Canals After Reaching Merced/San Joaquin Confluence 1988 to 1993.

BROOD YEAR	ESTIMATED SALMON ESCAPEMENT FOR MERCED RIVER	ESTIMATED SALMON ESCAPEMENT FOR WEST SIDE CANALS		ESTIMATED SALMON AT MERCED/SAN JOAQUIN CONFLUENCE		ESTIMATED % OF FISH STRAYING INTO WEST SIDE CANALS	
		TRAPPED LOW	ESTIMATED HIGH	LOW	HIGH	TRAPPED LOW	ESTIMATED HIGH
1988	3,168	1,150	2,300	4,318	5,468	26	42
1989	211	166	332	377	543	44	61
1990	73	142	284	215	357	66	79
1991	119	88	176	207	295	42	59
AVERAGE 1988-91	893	386	773	1,279	1,666	30	46
ELECTRIC BARRIER 1992	864	--	--	864	864		
PHYSICAL BARRIER 1993*	1,765	--	--	1,765	1,765		
AVERAGE 1988-93	1,033						

* Preliminary Documentation

It is reasonable to assume that the 1994 escapement of naturally spawning salmon for the Merced River will maintain or exceed the past 6-year average level of 825 fish (Table 2). An estimated 80 percent of these 825 fish will be adults. Therefore, at least 660 naturally spawning adult fall-run Chinook salmon will return to the Merced River in 1994.

Table 2. Estimated Naturally Spawning Salmon In The Merced River, 1988 to 1993.

BROOD YEAR	TOTAL ESTIMATED ESCAPEMENT OF MERCED RIVER	NUMBER OF ADULT AND GRILSE NATURALLY SPAWNING	NUMBER OF ADULTS AND GRILSE HATCHERY SPAWNED
1988	3,168	2,711	457
1989	211	129	82
1990	73	24	49
1991	119	78	41
1992	864	618	246
1993*	1,765	1,391	374
AVERAGE 1988-93	1,033	825	208

* Preliminary Data

The Central Valley Project Improvement Act (CVPIA) requires a doubling of the established 1967 to 1991 San Joaquin Chinook salmon average escapement level by 2002. A federal target of 5,810 naturally spawning adult fall-run salmon for the Merced River has been set (two times the 1967 to 1991 average of 2,905 naturally spawning adult salmon). It is appropriate to assume that this number of naturally spawning adult fish will be restored with the continuation of present and planned water habitat restoration efforts. Prorating the estimated 660 naturally spawning adult salmon in 1994 to 5,810 salmon in 2009 on a linear scale, an estimated 51,086 naturally spawning adult Chinook salmon are projected to return to the Merced River (Table 3).

Table 3. Estimated Naturally Spawning Adult Chinook Salmon Escapement For The Merced River Based On CVPIA Requirements, 1995 To 2009.

ESTIMATED CHINOOK SALMON ESCAPEMENT FOR THE MERCED RIVER: 1995 - 2009 NATURALLY SPAWNING ADULTS		
1995 1,003 salmon	2000 2,719 salmon	2005 4,436 salmon
1996 1,346 salmon	2001 3,062 salmon	2006 4,779 salmon
1997 1,689 salmon	2002 3,406 salmon	2007 5,122 salmon
1998 2,032 salmon	2003 3,749 salmon	2008 5,466 salmon
1999 2,376 salmon	2004 4,092 salmon	2009 5,809 salmon
1995-1999 Total 8,446 salmon	2000-2004 Total 25,474 salmon	2005-2009 Total 51,086 salmon

It has previously been stated that an average 38 percent of all salmon reaching the San Joaquin/Merced River confluence would stray up the San Joaquin River into west side canals. Therefore, it is assumed that the placement of the Hills Ferry barrier will save 38 percent of these 51,086 naturally spawning adult salmon from straying. This would imply that approximately 19,412 naturally spawning adult Chinook salmon could be directly attributed to the Hills Ferry Barrier Project. Therefore,we estimate a 15-year total production benefit of 1,651,947 smolt equivalents to Mossdale, or an average annual smolt credit of approximately 110,129 smolt equivalents to Mossdale (Table 4).

Table 4. Chinook Salmon Survival and Credit Analysis for the Hills Ferry Barrier 1995 to 2009.

		1995-2009 Merced River Estimated Escapement of Naturally Spawning Salmon 51,086
	FACTOR USED	
ESTIMATED SALMON STOPPED FROM STRAYING	0.38	19,412
* FEMALES STOPPED	0.47	9,123
ANNUAL EGG PRODUCTION (IN MILLIONS)	5,000 Eggs/Female	45.619
EGG TO FRY (IN MILLIONS)	0.41	18.704
FRY TO SMOLT (IN MILLIONS)	0.48	8.977
SMOLT IN TRIBUTARY (IN MILLIONS)	0.40	3.591
SMOLT IN MOSSDALE (IN MILLIONS)	0.46	1.651
TOTAL		1,651,947
COST OF PROJECT		$916,890
COST PER SMOLT		$0.56

* 1992 Percent of females in Merced River = 46.8%

Actual Benefits

It should be noted that many factors including flow rates, water quality, delta conditions, and commercial/sport harvest influence our ability to achieve these estimated benefits. These factors, and refinements to the benefit estimation procedures, will determine the actual annual mitigation benefits of this project. Annual smolt equivalents to Mossdale attributed to the Hills Ferry barrier can be calculated from actual annual escapement estimates. Region 4 personnel estimate naturally spawning salmon populations each year. The percentage of female spawners is determined. Thirty eight percent of these fish can be assumed to be saved by the Hills Ferry barrier.

EVIDENCE OF PROBABILITY OF ACHIEVING THE BENEFITS

Although assumptions of future salmon populations are made to calculate the estimated benefits for the 15 Year Hills Ferry Barrier Project, existing data strongly suggest that the project has significant influence on the salmon population of the Merced River. "Alaska Weir" structures have been used at many sites throughout the state and have been effective. The Hills Ferry Barrier has effectively operated for the past three years. The DFG will conduct spawning surveys as in the past to document natural and hatchery escapements in the Merced River. Rotary screw trapping near the Merced River confluence is being considered as an important addition to existing monitoring efforts. DFG's index of smolts passing Mossdale will continue to be monitored and refined. Assistance and additional funding may be necessary in the future to make further refinements (e.g., better flow estimates) to the smolt index at Mossdale. This data, combined with improved monitoring from other projects, should enhance the accuracy of benefit estimates for the Hills Ferry Barrier Project into the future.

COST OF THE PROJECT

The estimated cost of the entire 15-year project is $916,890 (Table 7). This estimate is based, in part, on a 15-year projection of estimated 1995 project operating cost of $41,650 compounded yearly with an annual inflation rate of 2.5 percent. This 1995 estimate consists of the following elements:

a. Permanent staff time to design weir, supervise construction and operation (0.5 PY F&W Assistant)	$ 18,000
b. Temporary help for fabrication, installation, and monitoring of the barrier (1 scientific aid, 640 hours, at $8.76/hour)	$ 6,320
c. Operating expenses (travel, road improvements, utilities, and rent)	$ 8,000
d. Construction materials	$ 1,000
e. Administrative cost at 25 percent	$ 8,330
1995 YEARLY TOTAL	**$ 41,650**

Table 7. 15-Year Operational Cost Projection for the Hills Ferry Barrier Project.

HILLS FERRY FISH BARRIER PROJECT COSTS (2.5% ANNUAL COST INCREASE)		
1995 - 1999	2000 - 2004	2005 - 2009
$ 218,920	$ 466,620	$ 746,890
15 [illegible]-Year Fish Barrier Operation Cost: $ 746,890 Mobile Trailer On Site Headquarters: $ 20,000 Land Acquisition: $ 150,000 **Total Project Cost: $ 916,890**		

Dividing the total project cost ($916,890) by our estimate of smolt equivalents results in cost/benefits of $0.56 per smolt over the 15-year project life. Funding for this project is requested from the Four-Pumps Annual Account. Improvements in basin flows, Delta protection, spawning habitat, hatchery production, and overall salmon management policy should help increase population numbers. This specific project will be the cornerstone in efforts to improve Merced River salmon stocks and will help to increase the actual mitigation credits for this and other Four-Pumps projects.

ENVIRONMENTAL CONSIDERATIONS

No significant adverse impacts are anticipated because of this project.

Permits from the State Lands Commission, Reclamation Board, U.S. Army Corps of Engineers, DFG, and the Regional Water Quality Control Board will be obtained for the life of the project, if possible. An appropriate environmental document will be prepared and filed pursuant to the California Environmental Quality Act.

CONCLUSION

This proposed project, costing an estimated $916,890 would meet the stated objectives of the DPFPA and provide a significant number of Chinook smolt equivalents to Mossdale annually. Over the 15-year life of the project, an estimate of 1,651,947 Chinook smolt equivalents would be credited to the salmon loss account. Funding of this project is requested from the Four-Pumps Annual Account. The annual cost is estimated at approximately $0.56/smolt and is comparable to several previous projects (Appendix 1). DFG will propose refinements to the project operation as new technology becomes available. A more comprehensive approach to monitoring benefits of multiple Four-Pumps projects will be considered.

Appendix I.

Summary of potential annual salmon credits and cost per fish for approved projects or projects under consideration for funding from the annual fish loss account.

Project	Estimated Annual Smolt Equivalents	Potential Cost/smolt
Hills Ferry Barrier (15-year)	110,129	$0.56
MRH Modernization	810,750	0.14
Merced Gravel I	21,727	0.55
Merced Gravel II	28,969	0.45
M.J. Ruddy, Tuolumne	51,089	0.44
Mill Creek Gravel	78,125	0.11
Riffles RM 51.2 & 52.0, Stanislaus River	17,850	0.39
Magneson site, Merced	5,688	1.55
Riffles 1B, 3A, 3B, Tuolumne	27,170	0.43
Riffles RM 47.4, 50.4, and 50.9, Stanislaus	40,419	0.29
Electrical Barrier, Phase I San Joaquin River 1992	32,952	2.05
Temporary physical barrier, San Joaquin River 1993	32,952	1.12